

**WHAT IS CLAIMED IS:**

- 1           1.     A work vehicle comprising:  
2                     a frame;  
3                     an axle assembly coupled to the frame and including a first axle  
4     shaft and a first axle housing, wherein the first axle shaft is disposed  
5     substantially within the first axle housing;  
6                     a first wheel coupled to the axle assembly;  
7                     an axle lubricating fluid disposed within the first axle housing;  
8     and  
9                     a first axle cooling device disposed within the first axle housing,  
10    in contact with at least a portion of the lubricating fluid, including a first coil.
- 1           2.     The work vehicle of claim 1, further comprising a cooling fluid  
2     contained within the first coil, wherein the first coil is configured to conduct  
3     cooling fluid therethrough and to maintain the cooling fluid separate from the  
4     lubricating fluid.
- 1           3.     The work vehicle of claim 2, further comprising a cooling fluid  
2     circuit fluidly coupled to the first coil, wherein the cooling circuit includes a  
3     cooling fluid pump and a cooling fluid reservoir, and wherein the first coil  
4     receives cooling fluid from the pump and delivers cooling fluid to the reservoir.
- 1           4.     The work vehicle of claim 3, further comprising a heat  
2     exchanger disposed in the cooling circuit between the first coil and the  
3     reservoir to remove heat from the cooling fluid.
- 1           5.     The work vehicle of claim 4, further comprising a control valve  
2     disposed to direct at least a portion of the cooling fluid to the first coil at a  
3     predetermined pressure difference across the first coil.
- 1           6.     The work vehicle of claim 3, further comprising a second wheel,  
2     wherein the axle assembly is further coupled to the second wheel and further

3 includes a second axle shaft, a second axle housing, and a second coil, and  
4 further wherein the second axle shaft and the second coil are disposed  
5 substantially within the second axle housing.

1 7. The work vehicle of claim 6, wherein an inlet of the second coil  
2 is in fluid communication with an inlet of the first coil and an outlet of the  
3 second coil is in fluid communication with an outlet of the first coil, and parallel  
4 flow paths are thereby provided through the first and second coils.

1 8. The work vehicle of claim 6, wherein:  
2 the cooling circuit further includes a crossover conduit;  
3 an inlet of the first coil receives cooling fluid from the pump;  
4 an outlet of the first coil delivers cooling fluid through the  
5 crossover conduit to an inlet of the second coil; and  
6 an outlet of the second coil delivers cooling fluid to the reservoir,  
7 the second coil being thereby coupled to the first coil in series  
8 flow relationship by the crossover conduit.

1 9. An axle assembly for a work vehicle, the axle assembly  
2 comprising:  
3 a first axle shaft and a first axle housing, wherein the first axle  
4 shaft is disposed substantially within the first axle housing;  
5 a second axle shaft and a second axle housing, wherein the  
6 second axle shaft is disposed within the second axle housing, and wherein  
7 the second axle shaft and the second axle housing are disposed coaxial with,  
8 and in opposing relationship to, the first axle shaft and the first axle housing,  
9 respectively;  
10 a first cooling device disposed within the first axle housing;  
11 a second cooling device disposed within the second axle  
12 housing;  
13 a differential gearset housing positioned intermediate the first  
14 and second axle housings and defining a chamber configured therein to  
15 receive a differential gearset;

16                   a differential gearset disposed within the chamber and rotatively  
17 coupled to the first and second axle shafts;  
18                   a lubricating fluid disposed within the first and second axle  
19 housings; and  
20                   a first axle cooling device disposed within the first axle housing,  
21 and a second axle cooling device disposed within the second axle housing.

1           10. The axle assembly of claim 9, further comprising a cooling fluid  
2 housed within the first and second axle cooling devices, wherein the first and  
3 second axle cooling devices are configured to conduct cooling fluid  
4 therethrough and to maintain the cooling fluid separate from the lubricating  
5 fluid.

1           11. The axle assembly of claim 10, wherein the first and second cooling  
2 devices include first and second coils, respectively, each coil configured to  
3 provide at least two passes of the cooling fluid through the lubricating fluid  
4 within each of the first and second axle housings.

1           12. The axle assembly of claim 11, wherein the work vehicle further  
2 includes a cooling fluid circuit for causing cooling fluid to flow through the first  
3 and second coils.

1           13. The axle assembly of claim 12, wherein the cooling circuit includes  
2 a cooling fluid pump and a cooling fluid reservoir and the first and second  
3 coils receive cooling fluid flowing from the pump and deliver it to the reservoir.

1           14. The axle assembly of claim 13, wherein the cooling circuit further  
2 includes a heat exchanger in fluid communication with the first and second  
3 coils.

1           15. The axle assembly of claim 13, wherein the cooling circuit further  
2 includes a control valve for directing at least a portion of the cooling fluid flow  
3 to the first and second coils at a predetermined pressure difference across the  
4 first and second coils.

1           16. The axle assembly of claim 15, wherein the control valve is  
2 configured as a back pressure regulating valve.

1           17. The axle assembly of claim 12, further comprising a crossover  
2 conduit for coupling an outlet of the first coil to an inlet of the second coil.

1           18. A method of cooling an axle assembly of a work vehicle, wherein  
2 the axle assembly includes an axle shaft, an axle housing configured to  
3 substantially surround the axle shaft, a cooling coil housed within the axle  
4 housing and having a passage therethrough and outer and inner surfaces, a  
5 lubricating fluid disposed within the axle housing, and a cooling fluid disposed  
6 within the passage, and further wherein the lubricating fluid is of a higher  
7 temperature than is the outer surface of the coil and the outer surface of the  
8 coil is of a higher temperature than is the cooling fluid, the method comprising  
9 steps of:  
10                 removing heat from the lubricating fluid by placing the lubricating  
11 fluid in contact with the outer surface of the coil; and  
12                 removing the heat from the inner surface of the coil by  
13 circulating the cooling fluid through the passage.

1           19. The method of claim 18, further comprising the step of:  
2                 directing flow of cooling fluid to the coil by using a back pressure  
3 regulating valve to impose a pressure difference across the coil.

1           20. The method of claim 19, further comprising the step of:  
2                 removing the heat from the cooling fluid by circulating the  
3 cooling fluid through a heat exchanger.